Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-778-RC2, 2018

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evolutionary Characteristics of Lightning and Radar Echo Structure in Thunderstorms Based on the TRMM satellite" *by* Xueke Wu et al.

Anonymous Referee #2

Received and published: 19 December 2018

This paper presents a statistical analysis of data from 16-years of TRMM precipitation radar and lightning imaging sensor for four regions with different terrain in subtropical East Asia. The results show different characteristics of the thunderstorms in the regions. They also suggest that the 30 dBZ echo top height is a good indicator for the occurrence of lightning in the regions.

It is important to provide analysis of such long-term datasets in order to compare with models of thunderstorms. Ultimately the results will contribute to an understanding of the physical processes.

Major comments.

1. There is no presentation of errors in e.g. the echo intensities, the altitude of the tops of echoes or the location and timing of the two signals (lightning and reflectivity).

2. Physical explanations should be presented for the results obtained. This is important because there are some differences between the current and previous results. There is little, or no discussion of these differences.

3. The results are discussed in the final section without reference to previous work, even when a different result is obtained. The discussion section should include such references.

4. There is very little new knowledge about thunderstorms and lightning in the paper. There are in fact several papers that present similar data, but with far more extensive analysis, albeit for different geographical regions.

Specific Comments.

Attention should be paid to the English throughout the manuscript. Words are often used incorrectly.

Lines 11-14. The sentence is not clear. Useful method for what?

Lines 30-33. It is not true that thunderstorms usually occur randomly in space and time. The initiation of convection depends on several phenomena that are becoming better understood. Convection that forms over mountains for example can be quite predictable.

Lines 65-68. It is not clear why lightning is an excellent indicator for studying convective intensity. Do you mean that the lightning frequency is related to the intensity of the convection, for example?

Lines 77-83. The results of these studies should be discussed.

Lines 86-91. The sentence should be more specific by stating what results have been found and what understanding is still required. The word "formation" is not correct.

Lines 96-102. There are many physical reasons for the situations described, likely including errors in the reflectivity values. None of these are discussed and really should be.

Lines 120-123. The advection of storms from one region to the other (e.g. from land to ocean) should be discussed somewhere.

Line 135. There should be a discussion of errors and their affect on the results associated with the values of the reflectivity, altitudes, locations and timing, as well as flash rates.

Line 142. There should be as much description of the properties of the clouds in the four regions as possible. Typical soundings should be shown for the days when there is convection. Important information includes estimated cloud base temperature, altitude of the 0 and -20C levels, and typical depth of clouds for example.

Line 143-144. The reader would be interested to know more about the results. Otherwise, I suggest deleting this sentence and ones like it.

Lines 144-146. Reference should be made to Byers and Braham.

Lines 151 onward. I think it's important to discuss the main result and physical explanations of the Bang and Zipser paper. There is no discussion of an MCS for example. The current discussion does not capture the development of convective systems.

Line 189. It would be interesting to know results concerning convection over the Tibetan plateau from previous studies.

Table 1. The table should give the units for height and maximum reflectivity.

Lines 193-196. It would be helpful to have a discussion in the Introduction of the relevance of the height of the 40 dBZ echo that other studies have found – i.e. with reference to the charging zone, and the size and concentration of graupel. The results here could then be put in context.

Line 204. Is the last column of Table 1 Maxdbz6-11?

Lines 206-207. What is the relevance of the high terrain?

Line 206. It would be best to use the same terms consistently.

Lines 218 - 224. The text should be replaced by an appropriate reference.

Lines 231-234 and Figure 3. It is odd that the frequency of convective to total rainfall over the Tibetan Plateau increases to 7% for a value of zero. More information should be given about why there is a problem with identification of the rain type.

Lines 275-276. It is implied here (I think) that if there is strong convection with e.g. a large trailing stratiform region, that it is a weak thunderstorm, which is not true.

Lines 316-317. This has been stated already.

Lines 317-324. A more in-depth discussion of the charging process should be given in the Introduction and this section deleted.

Line 325-331. Most of what is written here is well known and obvious. Echo top heights have been used before for this type of analysis.

Lines 338-340. This point should be mentioned earlier – see comment above.

Line 348. "Intuitive" is perhaps not the correct word.

Lines 350-351. The result should be discussed relative to other studies.

Line 360. I think it's better to delete "and confusing".

Lines 360-363. Please refer to the appropriate figure.

Lines 399-402. It doesn't seem necessary to make this statement.

Table 5. Please explain the headings in columns 2-5.

Lines 414-416. Is this not the definition of storm-type B?

Lines 423-425. Is that not obvious?

Lines 425-427. Again, obvious.

Lines 429-432. Why could the thunderstorms not simply be mature thunderstorms that are slightly weaker than Storm B type due to say less CAPE?

Lines 432-434. Likewise for C-type thunderstorms. Delete "fluffy cloud top structure".

Lines 440-442. This has been stated previously.

Lines 451-481. This is all quite obvious and well documented; most of the text should be deleted.

Lines 490-512. There is nothing new in this discussion. Most of it should be deleted.

Section 5. There are three main points. 1. The current results should be discussed with reference to previous work. 2. Physical explanations should be given for the results using results from previous work. 3. The section is too long and should be cut by about half.

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